CLAIMS

What is claimed is:

1. A meltblowing method comprising steps of:

dispensing a first fluid to form a first fluid flow at a first velocity;

dispensing a second fluid to form separate second fluid flows at a second velocity along substantially opposing flanking sides of the first fluid flow;

drawing the first fluid flow with the separate second fluid flows at a second velocity greater than the first velocity of the first fluid flow; and

non-convergently directing the first fluid flow and the separate second fluid flows along flanking sides of the first fluid flow,

wherein drawing the first fluid flow attenuates the first fluid flow to form a first fluid filament.

2. The method of Claim 1 further comprising steps of controlling a vacillation of the first fluid flow by varying one of a spacing between the first fluid flow and at least one of the separate second fluid flows, by varying an amount of at least one of the separate second fluid flows, and by varying a velocity of at least one of the separate second fluid flows.

3. The method of Claim 1 further comprising steps of:

dispensing the first fluid from a first orifice of a body member to form the first fluid flow;

terminating a supply of first fluid dispensed from the first orifice;

generating a high pressure zone proximate an output of the first orifice

with converging separate third fluid flows; and

blocking residual first fluid flow from the first orifice with the high pressure zone generated proximate the output of the first orifice after terminating the supply of first fluid.

4. The method of Claim 3 further comprising steps of redirecting the separate second fluid flows to form the converging third fluid flows.

5. The method of Claim 1 further comprising steps of:

dispensing the first fluid from a first orifice of a body member to form the first fluid flow;

forming separate first fluid flows from the first orifice by dispensing the first fluid through an increasingly large diameter of the first orifice and drawing the first fluid flow with the separate second fluid flows at a second velocity greater than the first velocity of the first fluid flow,

wherein the separate first fluid flows are attenuated to form corresponding separate first fluid filaments.

6. The method of Claim 1 further comprising steps of:

dispensing the first fluid from a first orifice of a body member to form the first fluid flow;

forming separate first fluid flows from the first orifice by generating a high pressure zone proximate an output of the first orifice with converging fourth fluid flows and drawing the first fluid flow with the separate second fluid flows at a second velocity greater than the first velocity of the first fluid flow,

wherein the separate first fluid flows are attenuated to form corresponding separate first fluid filaments.

7. The method of Claim 1 further comprising steps of directing in parallel the first fluid flow and the separate second fluid flows along flanking sides of the first fluid flow.

8. The method of Claim 1 further comprising steps of divergently directing the first fluid flow and the separate second fluid flows.

9. The method of Claim 1 further comprising steps of:

dispensing the first fluid to form a plurality of first fluid flows at the first velocity;

dispensing the second fluid to form a plurality of second fluid flows at the second velocity, the plurality of first fluid flows and the plurality of second fluid flows arranged in an alternating series so that each of the plurality of first fluid flows is flanked on substantially opposing sides by one of the plurality of second fluid flows;

drawing the plurality of first fluid flows with the plurality of second fluid flows at a second velocity greater than the first velocity of the plurality of first fluid flows; and

directing non-convergently the plurality of first fluid flows and the plurality of second fluid flows,

wherein plurality of first fluid flows are attenuated to form a plurality of first fluid filaments.

10. The method of Claim 9 further comprising steps of:

dispensing the first fluid from a plurality of first orifices of a body member to form the plurality of first fluid flows;

terminating a supply of first fluid dispensed from the plurality of first orifices;

generating a high pressure zone proximate an output of each of the plurality of first orifices with converging third fluid flows; and

blocking residual first fluid flows from the plurality of first orifices with the high pressure zone generated proximate the output of each of the plurality of first orifices after terminating the supply of first fluid.

11. The method of Claim 9 further comprising steps of:

dispensing the first fluid from a plurality of first orifices of a body member to form the plurality of first fluid flows;

forming separate first fluid flows from each of the plurality of first orifices by dispensing the first fluid through an increasingly large diameter of each of the plurality of first orifices and drawing the plurality of first fluid flows with the plurality of second fluid flows at a second velocity greater than the first velocity of the plurality first fluid flows,

wherein the separate first fluid flows are attenuated to form corresponding separate first fluid filaments.

12. The method of Claim 9 further comprising steps of:

dispensing the first fluid from a plurality of first orifices of a body member to form the plurality of first fluid flows;

forming separate first fluid flows from each of the plurality of first

orifices by generating a high pressure zone proximate an output of each of the plurality of first orifices with converging fourth fluid flows and drawing the plurality of first fluid flows with the plurality of second fluid flows at a second velocity greater than the first velocity of the plurality of the first fluid flows,

wherein the separate first fluid flows are attenuated to form corresponding separate first fluid filaments.

13. The method of Claim 9 further comprising steps of dispensing the first fluid to form the plurality of first fluid flows at the first velocity and at substantially the same mass flow rate.

14. The method of Claim 9 further comprising steps of controlling a vacillation of at least one of the plurality of first fluid flows by varying one of a spacing between at least one of the plurality of first fluid flows and at least one of the flanking plurality of second fluid flows, by varying an amount of at least one of the plurality of second fluid flows, and by varying a velocity of at least one of the plurality of second fluid flows.

15. The method of Claim 9 further comprising steps of controlling an amount of at least one of the plurality of first fluid flows by varying one of a corresponding first orifice size and a first fluid pressure across a corresponding first orifice.

16. The method of Claim 9 further comprising steps of:

substantially uniformly distributing the first fluid in a first restrictor cavity, the substantially uniformly distributed first fluid supplied from a first restrictor cavity inlet;

supplying the substantially uniformly distributed first fluid distributed in the first restrictor cavity from a first restrictor cavity outlet;

accumulating the substantially uniformly distributed first fluid supplied from the first restrictor cavity outlet in a first accumulator cavity;

supplying the substantially uniformly distributed first fluid accumulated in the first accumulator cavity from a first accumulator cavity outlet; and

dispensing the substantially uniformly distributed first fluid supplied from the first accumulator cavity outlet from a plurality of first orifices to form the plurality of first fluid flows at the first velocity and substantially the same mass flow rate.

17. The method of Claim 16 further comprising steps of:

substantially uniformly distributing the second fluid in a second restrictor cavity, the substantially uniformly distributed second fluid supplied from a second restrictor cavity inlet;

supplying the substantially uniformly distributed second fluid in the second restrictor cavity from a second restrictor cavity outlet;

accumulating the substantially uniformly distributed second fluid supplied from the second restrictor cavity outlet in a second accumulator cavity;

supplying the substantially uniformly distributed second fluid accumulated in the second accumulator cavity from a second accumulator cavity outlet; and

dispensing the substantially uniformly distributed second fluid supplied from the second accumulator cavity outlet from a plurality of second orifices to form the plurality of second fluid flows at the second velocity.

18. A meltblowing apparatus comprising:

a plurality of first orifices in a body member for dispensing a first fluid and forming a plurality of first fluid flows;

a plurality of second orifices in the body member for dispensing a second fluid and forming a plurality of second fluid flows;

the plurality of first orifices and the plurality of second orifices arranged in an alternating series so that each of the plurality of first orifices is flanked on substantially opposing sides by one of the plurality of second orifices;

the plurality of first orifices and the plurality of second orifices oriented to non-convergently direct the plurality of first fluid flows and the plurality of second fluid flows, and

the plurality of first orifices and the plurality of second orifices spaced so that the plurality of first fluid flows at a first velocity are drawable from the plurality of first orifices by the plurality of second fluid flows at a second velocity greater than the first velocity,

wherein drawing the plurality of first fluid flows attenuates the plurality of first fluid flows to form a plurality of first fluid filaments.

19. The apparatus of Claim 18 further comprising:

a plurality of third orifices in the body member for dispensing a third fluid and forming a plurality of third fluid flow,

the plurality of third orifices arranged to converge the third fluid flows and generate a high pressure zone proximate an output proximate each of the plurality of first orifices,

wherein the high pressure zone blocks residual fluid flow from the corresponding first orifice after terminating a supply of first fluid.

20. The apparatus of Claim 18 wherein the plurality of first orifices and the plurality of second orifices are oriented to direct the plurality of first fluid flows and the plurality of second fluid flows in parallel.

21. The apparatus of Claim 18 wherein the plurality of first orifices and the plurality of second orifices oriented to divergently direct the plurality of first fluid flows and the plurality of second fluid flows.

22. The apparatus of Claim 18 further comprising:

a first means for substantially uniformly distributing first fluid supplied to the plurality of first orifices to form the plurality of first fluid flows at the first velocity and at substantially the same mass flow rate; and

a second means for substantially uniformly distributing second fluid supplied to the plurality of second orifices to form the plurality of second fluid flows at the second velocity.

23. The apparatus of Claim 22 further comprising a third means for generating a high pressure zone proximate an output of each of the plurality of first orifices with converging third fluid flows, wherein the high pressure zone blocks residual fluid flow from the corresponding first orifice after terminating a supply of first fluid.

24. The apparatus of Claim 22 further comprising fourth means for

forming separate first fluid flows from each of the plurality of first orifices.

25. The apparatus of Claim 24, the fourth means comprising an increasing aperture coupled to each of the plurality of first orifices, wherein the separate first fluid flows are formable from each of the plurality of first orifices by drawing the plurality of first fluid flows with the plurality of second fluid flows at a second velocity greater than the first velocity of the plurality first fluid flows.

26. The apparatus of Claim 24, the fourth means comprising a high pressure zone generated proximate an output of each of the plurality of first orifices with converging fourth fluid flows, wherein the separate first fluid flows are formable from each of the plurality of first orifices by drawing the plurality of first fluid flows with the plurality of second fluid flows at a second velocity greater than the first velocity of the plurality first fluid flows.

27. The apparatus of Claim 18 further comprising:

a first restrictor cavity in the body member, the first restrictor cavity having a first restrictor cavity inlet and a first restrictor cavity outlet;

a first accumulator cavity in the body member, the first accumulator cavity having a first accumulator cavity inlet coupled to the first restrictor cavity outlet, and the first accumulator cavity having a first accumulator cavity outlet coupled to the plurality of first orifices,

wherein first fluid supplied to the first restrictor cavity inlet is substantially uniformly distributed to the plurality of first orifices to form the plurality of first fluid flows at the first velocity and at substantially the same mass flow rate.

28. The apparatus of Claim 27 further comprising:

a second restrictor cavity in the body member, the second restrictor cavity having a second restrictor cavity inlet and a second restrictor cavity outlet;

a second accumulator cavity in the body member, the second accumulator cavity having a second accumulator cavity inlet coupled to the second restrictor cavity outlet, and the second accumulator cavity having a second accumulator cavity outlet coupled to the plurality of second orifices,

wherein second fluid supplied to the second restrictor cavity inlet is substantially uniformly distributed to the plurality of second orifices to form the plurality of second fluid flows.

29. The apparatus of Claim 18, each of the plurality of second orifices disposed in a corresponding aperture of the body member to recess the plurality of second orifices in the body member relative to the plurality of first orifices.

30. The apparatus of Claim 18, each of the plurality of second orifices disposed in a corresponding increasing aperture of the body member to recess the plurality of second orifices in the body member relative to the plurality of first orifices.

31. The apparatus of Claim 18, further comprising a plurality of at least two body members arranged adjacently, wherein the alternating series of first orifices and second orifices of each body member is aligned in series with the alternating series of first orifices and second orifices of an adjacent body member.

32. The apparatus of Claim 18, wherein the body member is a die assembly comprising a plurality of laminated members.

33. The apparatus of Claim 32, the plurality of laminated members of the die assembly comprising:

a first plate having a first restrictor cavity in the body member, the first restrictor cavity having a first restrictor cavity inlet and a first restrictor cavity outlet;

a second plate having first accumulator cavity in the body member, the first accumulator cavity having a first accumulator cavity inlet coupled to the first restrictor cavity outlet, and the first accumulator cavity having a first accumulator cavity outlet coupled to the plurality of first orifices; and

a third plate having the plurality of first orifices and the plurality of second orifices,

wherein first fluid supplied to the first restrictor cavity inlet is substantially uniformly distributed to the plurality of first orifices to form the plurality of first fluid flows at the first velocity and at substantially the same mass flow rate.

34. The apparatus of Claim 33 further comprising:

a fourth plate having a second restrictor cavity in the body member, the second restrictor cavity having a second restrictor cavity inlet and a second restrictor cavity outlet;

a fifth plate having a second accumulator cavity in the body member, the second accumulator cavity having a second accumulator cavity inlet coupled to the second restrictor cavity outlet, and the second accumulator cavity having a second accumulator cavity outlet coupled to the plurality of second orifices,

wherein second fluid supplied to the second restrictor cavity inlet is

substantially uniformly distributed to the plurality of second orifices to form the plurality of second fluid flows.

35. The apparatus of Claim 33, further comprising

a sixth plate between the first plate and the second plate, the sixth plate having a plurality of passages coupling the first restrictor cavity and the first accumulator cavity; and

a seventh plate between the second plate and the third plate, the seventh plate having a plurality of passages coupling the first accumulator and the plurality of first orifices,

wherein the plurality of passages in the sixth plate and the plurality of passages in the seventh plate are dimensioned to substantially uniformly distribute the first fluid supplied from the first restrictor cavity to the plurality of first orifices.

36. The apparatus of Claim 34, further comprising:

a eighth plate between the fourth plate and the fifth plate, the eighth plate having a plurality of passages coupling the second restrictor cavity and the second accumulator cavity; and

a ninth plate between the second plate and the third plate, the ninth plate having a plurality of passages coupling the second accumulator cavity and the plurality of second orifices,

wherein the plurality of passages in the eighth plate and the plurality of passages in the ninth plate are dimensioned to substantially uniformly distribute second fluid supplied from the second restrictor cavity to the plurality of second orifices.

37. The apparatus of Claim 34, the third plate comprising:

a tenth plate having the plurality of first openings and the plurality of second openings;

an eleventh plate with a plurality of first ports coupling the first accumulator cavity to the plurality of first openings in the tenth plate; and

a twelfth plate with a plurality of second ports coupling the second accumulator cavity to the plurality of second openings in the tenth plate,

wherein the tenth plate is disposed between the eleventh plate and the twelfth plate to form the plurality of first orifices and the plurality of second orifices.

38. The apparatus of Claim 34 further comprising:

a thirteenth plate having a third restrictor cavity coupled to a third fluid inlet;

a fourteenth plate having a third accumulator cavity and a plurality of converging fluid orifices;

a fifteenth plate between the thirteenth plate and the fourteenth plate, the fifteenth plate having a plurality of fluid passages coupling the third restrictor cavity and the third accumulator cavity;

a sixteenth plate having a cavity coupling the third accumulator cavity and the plurality of converging fluid orifices fourteenth plate;

a seventeenth plate having a fourth restrictor cavity coupled to a fourth fluid inlet;

an eighteenth plate having a fourth accumulator cavity and a plurality of converging fluid orifices;

a nineteenth plate between the seventeenth plate and the eighteenth plate, the nineteenth plate having a plurality of fluid passages coupling the fourth restrictor cavity and the fourth accumulator cavity; and

a twentieth plate having a cavity coupling the fourth accumulator cavity and the plurality of converging fluid orifices of the eighteenth plate,

wherein third fluid supplied to the third fluid inlet and to the fourth fluid inlet is directed to converge and form a high pressure zone proximate the plurality of first orifices.

39. The apparatus of Claim 38 further comprising a fluid interface plate having a first fluid inlet, a second fluid inlet and a third fluid inlet, the first fluid inlet of the fluid interface plate coupled to the first restrictor cavity of the first plate, the second fluid inlet of the fluid interface plate coupled to the second restrictor cavity of the fourth plate, and the third fluid inlet of the fluid interface plate coupled to the third fluid inlet of the thirteenth plate and to the fourth fluid inlet of the seventeenth plate.

40. The apparatus of Claim 39, the fluid interface plate is a fluid switching interface plate comprising a common fluid inlet coupling the second fluid inlet and the third fluid inlet, and a control fluid inlet for switching fluid supplied to the common fluid inlet between the second fluid inlet and the third fluid inlet.

41. The apparatus of Claim 39 further comprising a die adapter assembly having a first die assembly interface for mounting a die assembly, the first die assembly interface having a first fluid supply outlet for supplying first fluid to the first fluid inlet of the fluid interface plate, the first die assembly interface having a second fluid supply outlet for supplying second fluid to the second fluid inlet of the fluid interface plate, and the first die assembly interface having a third fluid supply outlet

for supplying third fluid to the third fluid inlet of the fluid interface plate.

42. The apparatus of Claim 41 comprising a plurality of at least two die adapter assemblies arranged adjacently to form a plurality of corresponding adjacently arranged die assemblies.

43. The apparatus of Claim 18 further comprising a die adapter assembly having a first die assembly interface for mounting a die assembly, the first die assembly interface having a first fluid supply outlet for supplying first fluid to the die assembly, and the first die assembly interface having a second fluid supply outlet for supplying second fluid to the die assembly.

44. The apparatus of Claim 43, the die adapter assembly having a second die assembly interface for mounting a die assembly, the second die assembly interface having a first fluid supply outlet for supplying first fluid to the die assembly, and the second die assembly interface having a second fluid supply outlet for supplying second fluid to the die assembly.

45. The apparatus of Claim 18, further comprising a plurality of at least two orifice arrays, each orifice array formed of a first orifice and two second orifice disposed on substantially opposing side of the first orifice, wherein the plurality of orifice arrays are arranged in a parallel orientation.

46. The apparatus of Claim 18, further comprising a plurality of at least two orifice arrays, each orifice array formed of a first orifice and two second orifice disposed on substantially opposing side of the first orifice, wherein the plurality of orifice arrays are arranged in a non-parallel orientation.

47. The apparatus of Claim 18, further comprising a plurality of at least two orifice arrays, each orifice array formed of a first orifice and two second orifice disposed on substantially opposing side of the first orifice, wherein the plurality of orifice arrays are arranged on separate faces of the body member to provide a first fluid flow in three dimensions.